EDUC 555
Assessment & Intervention

Class #8

One, Two, Three, Many . . .

One, Two, Three, Many . . .

From the perspective of a math teacher, this means that instruction in math will be built almost entirely on prerequisite learned skills rather than on maturational-based knowledge.

- William N. Bender, PhD
Professor, College of Education, University of Georgia

One, Two, Three, Many . . .

From the perspective of a
multi-tiered system of support (RtI),
this means that we move from
"mathematics for a few" to
"mathematics for *every* student".

Gone are the days of
"I taught it, but they didn't get it… I'm moving on" and now is the time for greater expectations and outcomes for both us and our students.

“We did then
what we knew how to do,
when we knew better,
we did better.”

~ Maya Angelou

Class 8 Objectives

Core (Tier 1) Instruction:

- Increase our understanding of Evidence-Based Practice
- Increase our understanding and application of High-Yielding Instructional Practices

The ABCs of Evidence-Based Practice for Teachers

1. Individually, answer the **Before Reading** question in the ABC's of Evidence graphic organizer.
2. On your own, **read the article** ABC's of Evidence-Based Practices for Teachers.
3. Reread the portion of the article about research-based practices, scientifically-based research, and evidence-based practices, and compare/contrast the three in the **During Reading** portion of your ABC's of Evidence graphic organizer.
4. Answer the **After Reading** question, and discuss this question and your answer with your small group.
5. Take note of **What are you still wondering about?** for whole group discussion.


Take a
Break
6 2 11 7 8 7 12 4 10 9 3 5

Research Informed (HIGH-YIELDING) Practices in Mathematics

- CBMs meet extensive evidence-based research criteria for benchmark and progress assessments to measure student response to research-based instruction
- Scientifically-based math curriculum that incorporates effective instruction techniques
- Importance of early mastery of both number sense and math computation fluency

Research Findings on Effective Math Instruction

Effective math instruction includes a focus on:

- Basic Skills
- Teaching explicitly and systematically
- Frequent progress monitoring data to inform instruction and student progress

(Baker, Gerston, & Lee, 2002)

The Role of Diagnosis and Remediation in Tier 1

- Included in Tier 1 instruction because there may be a need to reteach some skills or concepts multiple times for the benefit of all students
- The need to reteach is informed by regular formative assessment
- Diagnosis at Tier 1 involves identifying problems in the learning process and adjusting instruction for the entire class
- Differentiated instruction is a direct application of diagnosis at Tier 1

Core Instruction

- Defined
  - Evidence-based practices selected by the district and school to teach ALL students the common core state standards and social behavior standards
- Math
  - Process: Concrete, Representational, Abstract
  - Explicit Instruction: I do it, We do it, Y'all do it, You do it
  - Engagement: ALL students saying, writing, doing
  - High probability of success for most students (80-90%)

Learning is not a spectator sport!

- “There is now a massive amount of evidence from all realms of science that unless individuals take a very active role in what it is that they’re studying, unless they learn to ask questions, to do things hands-on, to essentially recreate things in their own mind and transform them as is needed, the ideas just disappear.”

-Howard Gardner, Professor in Cognition and Education, Harvard

Student Engagement

- Defined: to attract and maintain a learner's interest and active involvement in all lesson content and related tasks, with clearly articulated evidence checks of concrete, productive Response to Instruction
- ALL Students, EVERY LESSON
- We cannot close the achievement gap unless we dramatically increase engagement or student response to instruction

Dr. Kevin Feldman

90% of Engagement Comes Down to the Quantity & Quality of Student

- Saying—Oral Language
- Writing—Written Language
- Doing—pointing, touching, demonstrating, etc.

Feldman

“It’s not what you say or do that ultimately matters... It **IS** what you get the students to do as a result of what you said and did that counts.”

Feldman

An example of Engagement

What did you notice?

- What engagement strategies were used?
- How might you use the observed strategies?

"Math Wars"

Dispute over best way to teach math

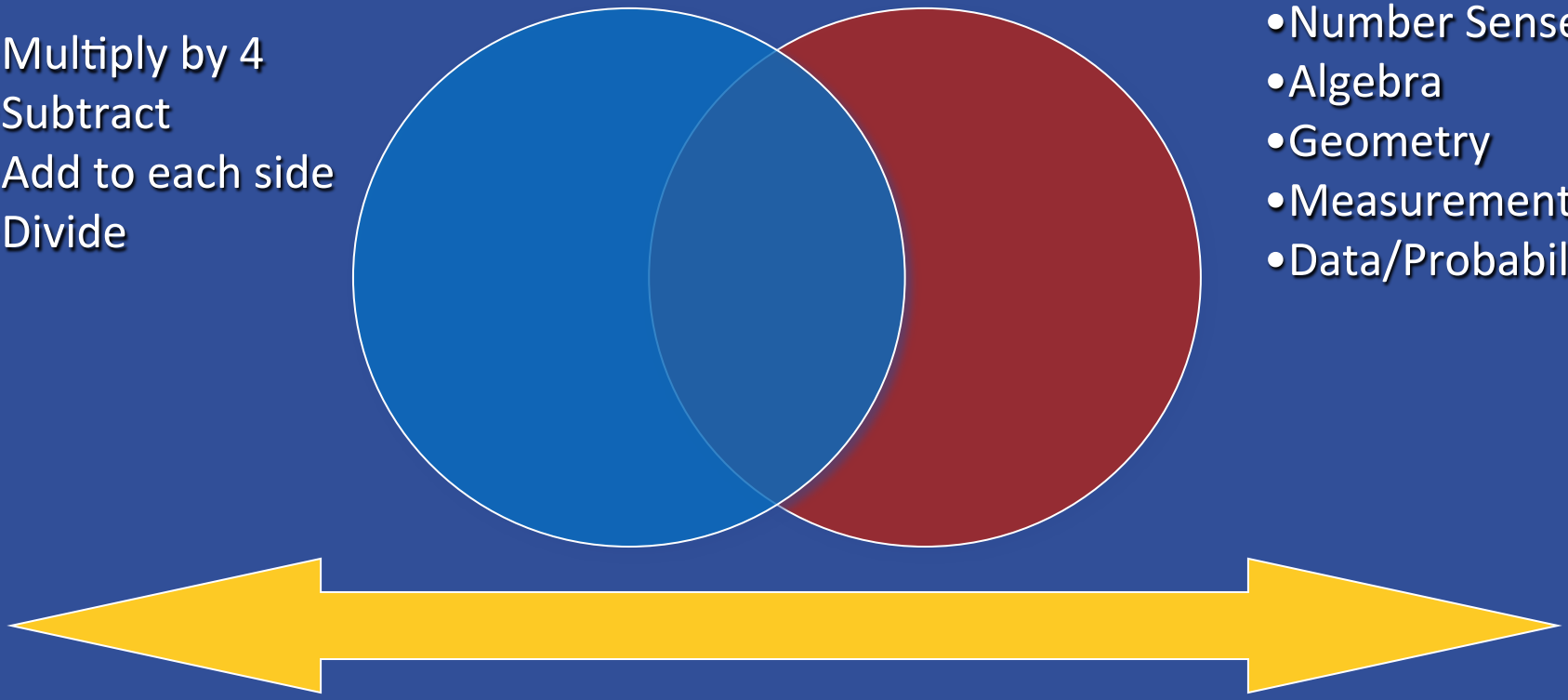
Process vs. Concept

Worksheets vs. Manipulatives

Skill vs. Idea

Procedure vs. Concept

- Multiply by 4
- Subtract
- Add to each side
- Divide



- Number Sense
- Algebra
- Geometry
- Measurement
- Data/Probability

How to

Idea

Procedural vs. Conceptual Tools

- Worksheets
- Rote memorization
- Flash cards
- Step by step
- Formulas
- Calculators

- Fraction bars
- Counters
- Base 10 blocks
- Rulers

How to

Idea

National Math Panel Results

"Conceptual understanding, computational and procedural fluency and problem-solving skills are equally important and mutually reinforce each other. Debates regarding the relative importance of each of these components of mathematics are misguided."

(National Math Panel, 2008)

A case for accurate computation AND conceptual understanding…

We need BALANCE in mathematics…

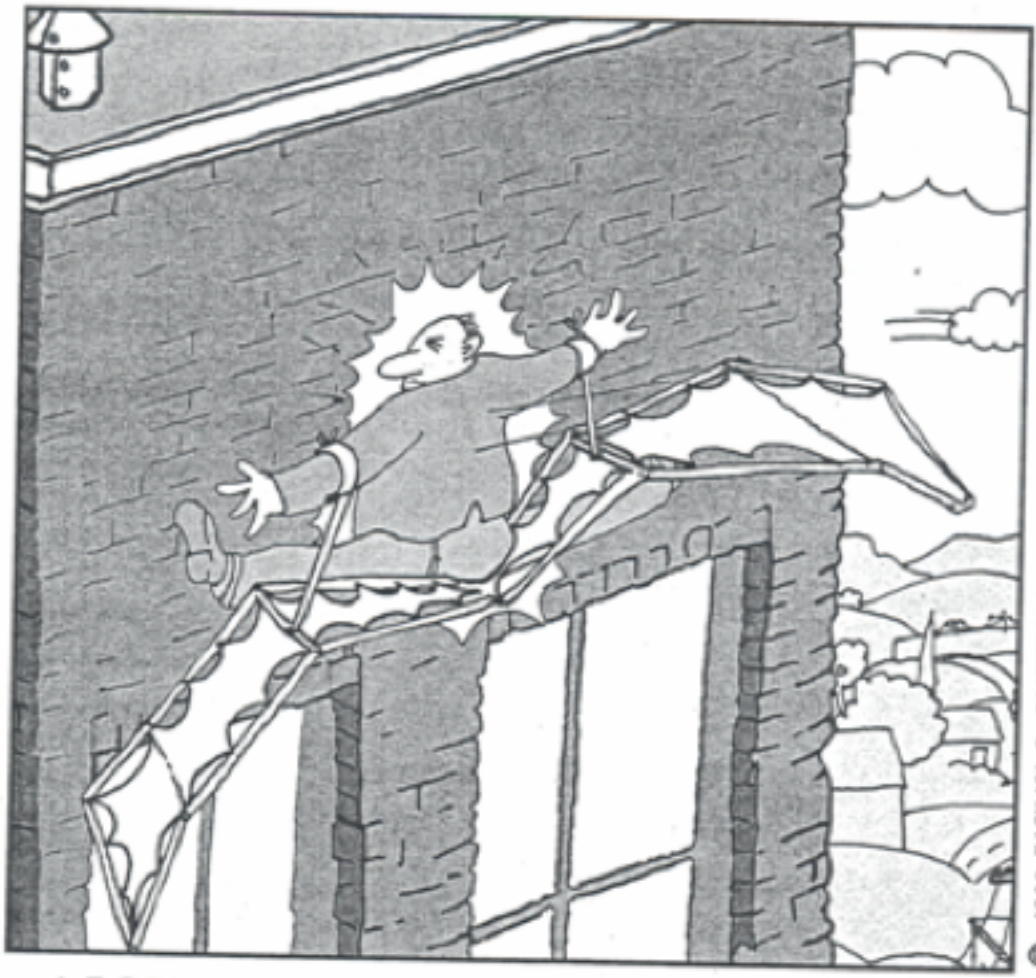
CONCEPT/APPLICATION + COMPUTATION

= STUDENT ACHIEVEMENT

At the Elementary Level, Most Students that Struggle in Math Have Difficulty with:

- Solving problems (Montague, 1997; Xin Yan & Jitendra, 1999)
- Visually representing problems (Montague, 2005)
- Processing problem information (Montague, 2005)
- Memory (Kroesbergen & Van Luit, 2003)
- Self-monitoring (Montague, 2005)
- Fluency of math facts (Fuchs, 2005)

What should we do for these students?



What to do?

- Implement an effective core curriculum based on
  - Critical mathematics content (Common Core State Standards)
  - Scientifically Research-based instructional design principles (EnVision Math)

- Ensure student understanding through high-quality **INSTRUCTION** using both student-centered and teacher-centered strategies.
  - Procedural Understanding/Skill Acquisition (Instructional Focus Continuum)
  - Conceptual Understanding (CRA model)
  - Scaffolded Instruction (I do, We do, Ya'all do, You do)
  - Immediate feedback

- Use reliable assessment tools
  - Regular formative assessment (District CFA's)
  - Benchmark screening and progress monitoring (M-CBM's)

~ Foundations for Success: The Final Report of the National Mathematics Advisory Panel (2008).

INSTRUCTION

HOW do I teach . . .

Research on Effective Instruction indicates:

- Quality of Instruction - reflects quality of curriculum, lesson preparation, and teaching skill
- Appropriate Level - lesson is neither too easy nor too difficult
- Effective Pacing – time is used efficiently, the pace is "perky"
- Incentive - students are engaged and motivated to learn

Instructional Focus Continuum

Accurate at Skill	Fluent at Skill	Able to Apply Skill
If no, teach skill. If yes, move to fluency	If no, teach fluency/ automaticity If yes, move to application	If no, teach application If yes, then move to higher level/concept

Instructional Strategies for Building Skill Accuracy

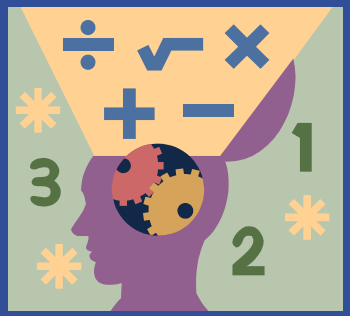
- Explicit Teaching
  - Teacher modeling, guided practice, independent practice
- Teacher Feedback
  - Specific positive confirmations
  - Corrective feedback on errors
- "Cover, copy, compare"

Explicit Instruction

- What is Explicit?
  - Precise and consistent language
  - Clear, accurate, and unambiguous teaching
  - I do it, we do it, Y'all do it, You do it
  - Why is it important?
    - Often when students encounter improper fractions (e.g. 5/4) the strategies they were taught using a single unit don't work.
    - Many commercially developed programs suggest that students generate a number of alternative problem solving strategies. Teachers need to select only the most generalizable, useful, and explicit strategies (Stein, 2006).

Explicit Instruction

- High Achieving countries all implement connections problems as connections problems
- U.S. implements connection problems as a set of procedures

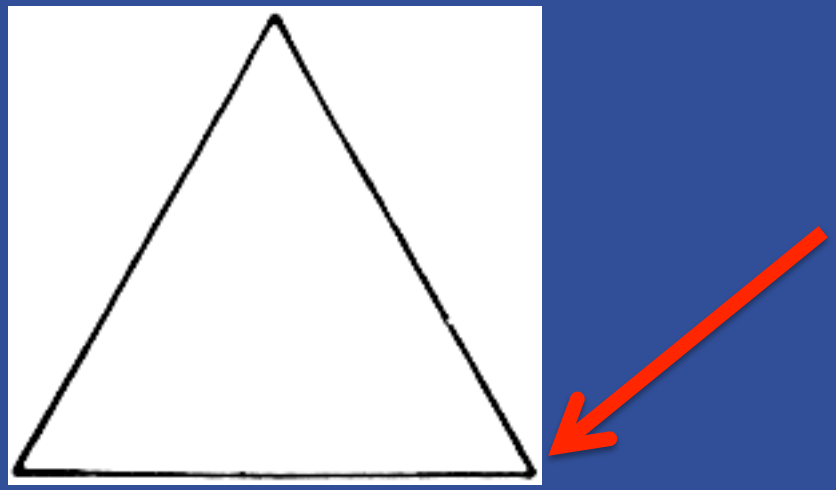


Precise and Consistent Language

Kids are like Sponges!

Ambiguous Language Examples

$4 < 7$ $8 > 2$



What NOT to teach…

- Math strategies that do not support
  - Future learning
    - EX: "When subtracting, the larger number ALWAYS goes on top." Is this ALWAYS true?
  - Accurate conceptual understanding
    - EX: "When subtracting, borrow a 1 from the tens place." Does this develop a correct understanding of this concept?

Error-Correction Procedures

- Error correction is a key feature of effective instruction
- Error corrective feedback is crucial to the accuracy and efficiency of student learning
- If errors are identified and corrected immediately in the learning sequence, students will master the concept/skill more quickly and with less frustration

An example of effective correction

Treatment Integrity for Cover, Copy, & Compare

1. Provided worksheet with problems and solutions on the lefts side of the page and the same problems without answers to the left of the page.

2. Provided checklist of the steps to complete.

3. Watched each student to be sure they are doing steps correctly.

4. Provided error correction and specific praise as needed.

Student Directions for Cover, Copy, Compare

_____ Look at the problem and the answer.

_____ Cover the problem and answer.

_____ Write the answer.

_____ Uncover the problem and check if you wrote the answer correctly.

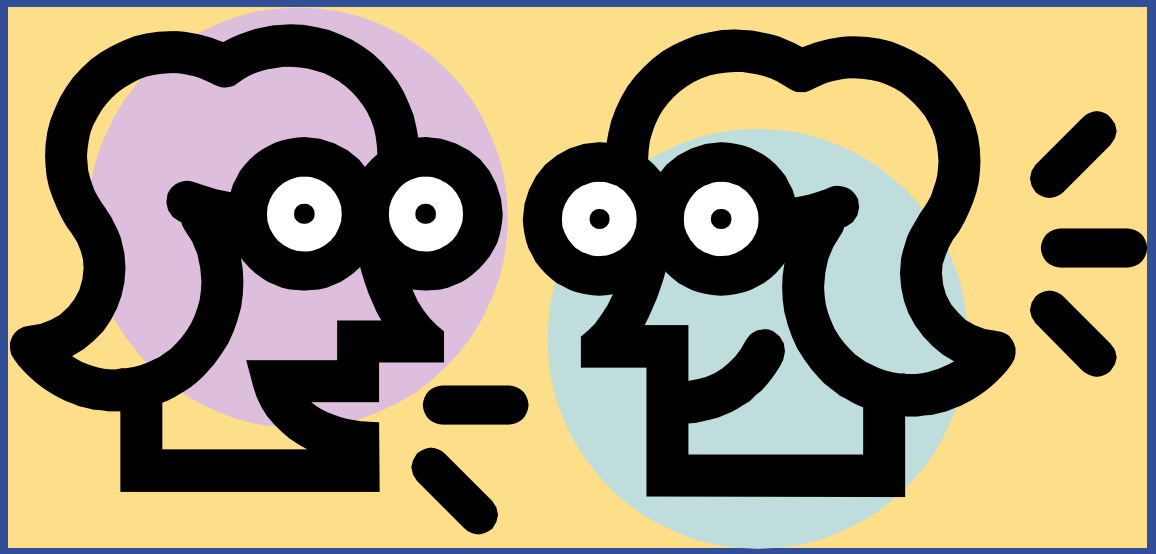
_____ If your answer is not the same, try again until it is.

Cover, Copy, Compare

Skill Probe Generator:

http://www.lefthandlogic.com/mathprobe_old/allmult.php

Share with a partner any additional ideas you have for building accuracy in a skill.



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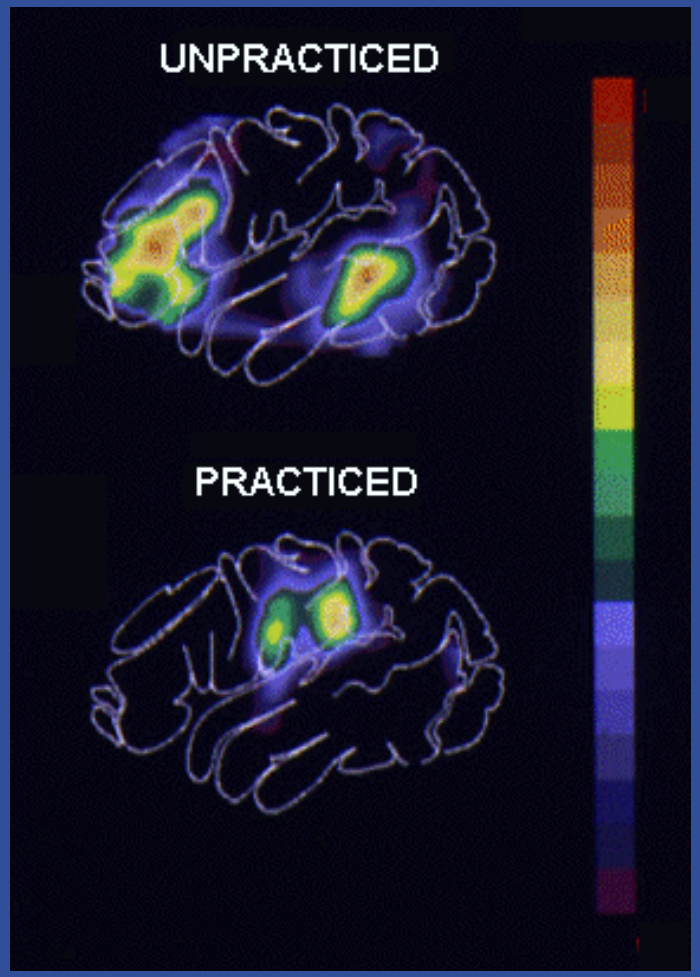
Instructional Strategies for Building Skill Fluency

- Multiple exposures to skill or concept: Practice!
- Goal setting for increased automaticity
- Computer games
- Peer games

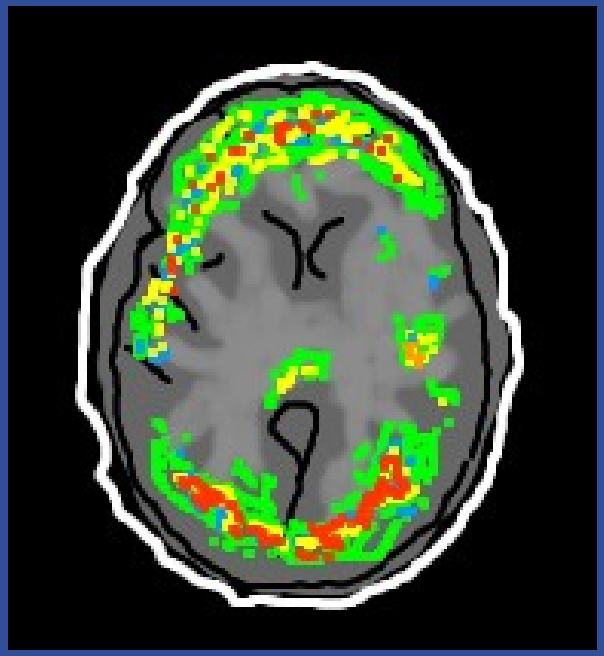
What is fluency?



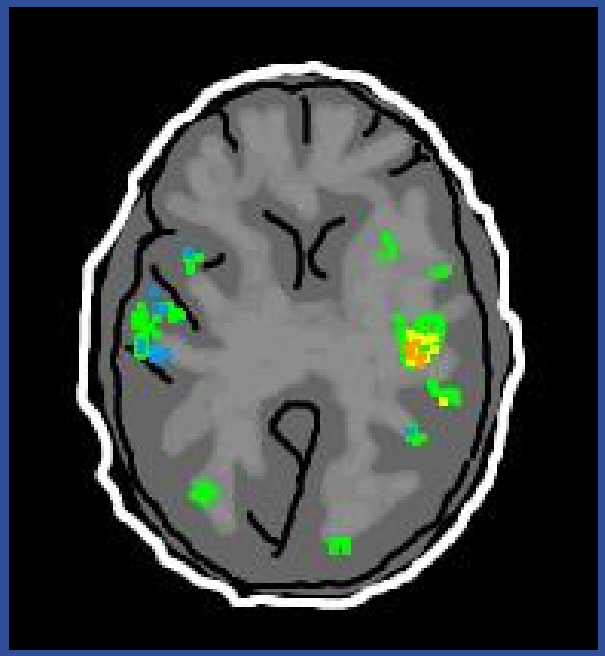
Automatic Processing

- Consistent mapping between stimulus and its categorization and response (Shiffrin & Schneider, 1977)
  - Visual search with same targets and distractors
  - a, e, u = vowels; c, g, k = consonants
  - driver seat in car on left side; drive on right side of road
- Extensive practice
- Consistent mapping and practice can lead to automaticity

Automaticity and the Brain



Before consistently-mapped practice—resource loading



After consistently-mapped practice—automaticity

"Practice, Practice, Practice"

- Purpose: To help students develop accuracy with basic computation skills
- Research: Stein, Kinder, Silbert, & Carnine, 2006
- Ingredients: Computation problems matched to students' independent practice level
- Prep Time: 5-10 minutes
- Activity Time: 5-10 minutes

Intervention Central
Math Practice Worksheet Generator

- Go to the following website: www.interventioncentral.org
- In the section labeled "Online Tools" click on "Math Worksheet Generator" on the right hand side of the page.
- When the new math page loads, click on the button labeled "mixed skills".
- Click on the specific skill(s) you want included in your practice worksheet.

Intervention Central: Math Practice Worksheet Generator, Cont'd

- At the bottom of the page choose how many columns, rows, and what size font you want students to use.
- Click on "Single Skill Computation Probe."
- Once you click on the button to create the probe, your browser should create and load a new tab or page with the teacher (answer) key first. Once this page is loaded, click on the text at the very top of the page which says "click for student worksheet."
- Another new tab or page will load. This is the one you want to print for the students. Either print as many copies as you need for the students, or print one copy and then make enough photocopies.
- Print a copy of the answer sheet onto an overhead transparency.

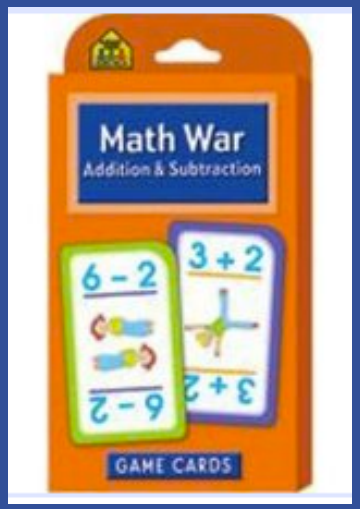
(Brown-Chidsey, Bronaugh, & McGraw, 2008)

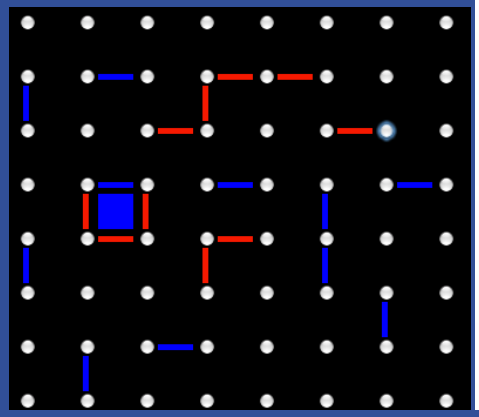
Computer Resources for Building Math Skill Fluency

- http://www.internet4classrooms.com/grade_level_help.htm
- http://nlvm.usu.edu/en/nav/index.html
- http://www.gamequarium.org/dir/Gamequarium/Math/
- http://cte.jhu.edu/techacademy/web/2000/heal/mathsites.htm

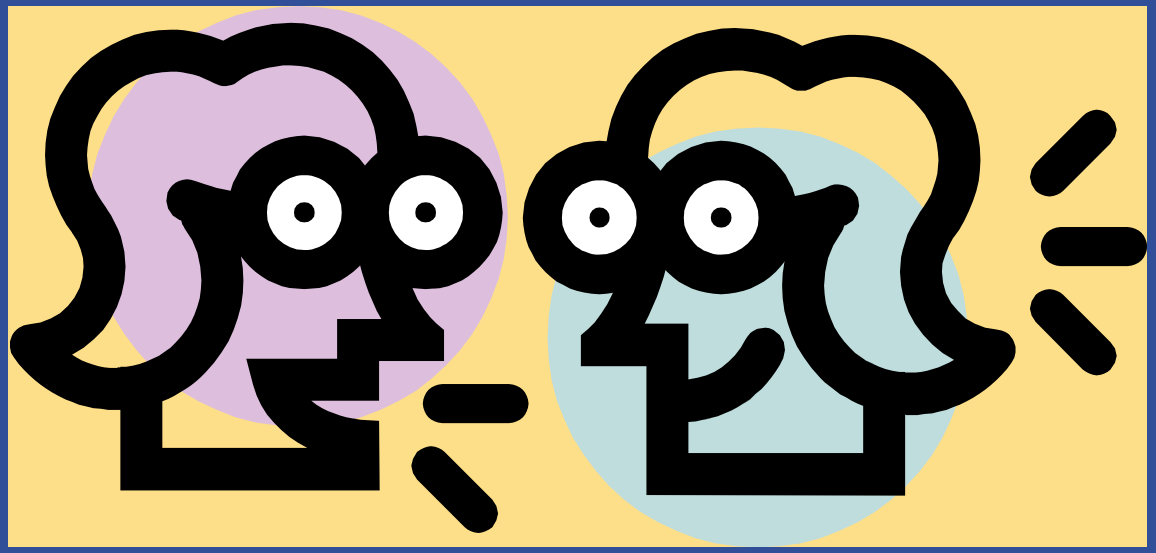
Peer Math Games

- Math Fact WAR w/Flash cards
- Dot Game w/Flash cards or Dice
- Math Fact Bingo





Share with your table any additional ideas you have for building fluency in a skill.



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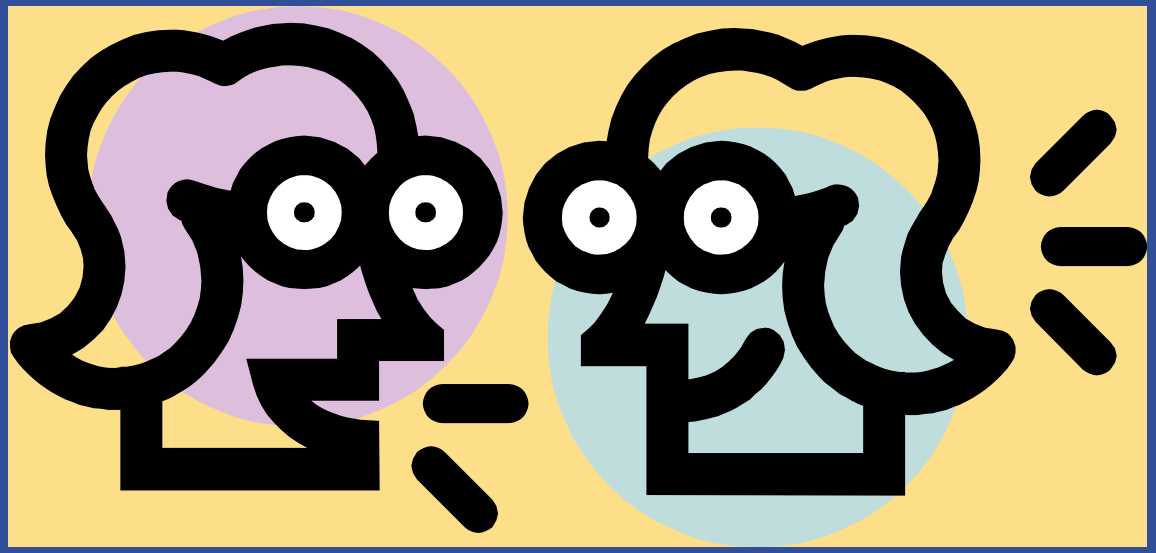
Instructional Strategies for Building Skill Application

- Word Problem Solving
- Use questioning strategies that require learners to go deeper
- Peer tutoring (Peer Assisted Learning Strategies)

Share with the class any additional ideas you have for building application in a skill.



What to do?

- Ensure student understanding through high-quality instruction using both student-centered and teacher-centered strategies.
  - ~~Procedural Understanding/Skill Acquisition (Instructional Focus Continuum)~~
  - Conceptual Understanding (CRA model)
  - Scaffolded Instruction (I do, We do, Ya'all do, You do)

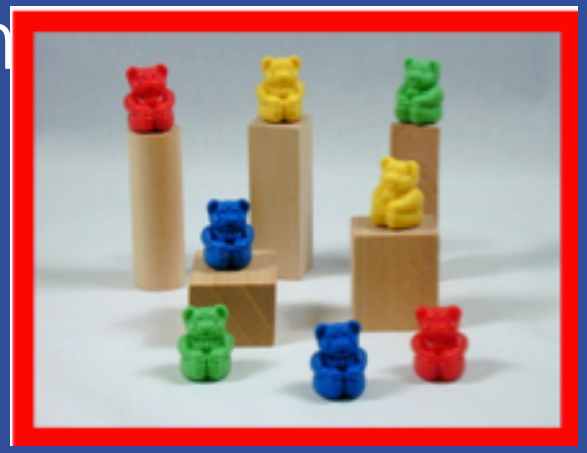
~ Foundations for Success: The Final Report of the National Mathematics Advisory Panel (2008).

Concrete-Representational-Abstract Instructional Approach (C-R-A)

- **C**ONCRETE: Uses hands-on physical models or manipulatives to represent numbers and unknowns.
- **R**EPRESENTATIONAL: Draws or uses pictorial representations of the models.
- **A**BSTRACT: Involves numbers as abstract symbols of pictorial displays.

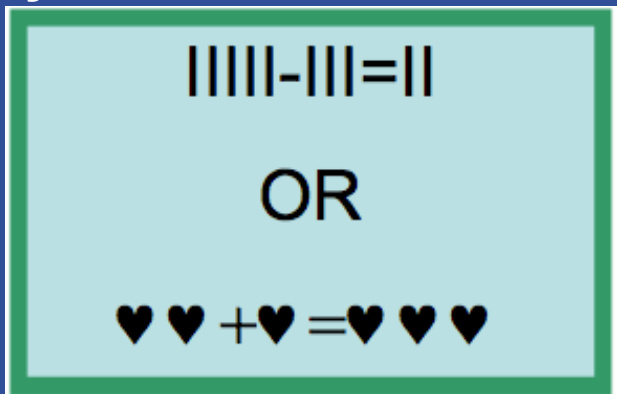
Concrete Level

- Definition: A teaching method that uses actual objects such as people, shoes, toys, fruits, cubes, base-ten blocks, or fraction tiles.
- What concrete items have you used in your classroom to teach math



Representational Level

- Definition: A teaching method that uses pictures, tally marks, diagrams, and drawings. These pictorial representations relate directly to the manipulatives and set up the student to solve numeric problems without pictures.
- From your experiences, what have you used that is representational in your math classroom?



Abstract Level

- Definition: A teaching method that uses written words, symbols (such as variables or numerals), or verbal expressions.

Sam put 18 pencils in 3 equal groups. How many pencils are in each group?

$10-a=5$

Steve has 3 toy cars. If there are 4 wheels on each car, how many wheels are there on his toy cars?

Concrete	Representational	Abstract
With your partner, come up with 2- 3 different ways you would teach this problem using CONCRETE manipulatives	With your partner, come up with 2- 3 different ways you would teach this problem using REPRESENTATION	With your partner, come up with 2- 3 different ways you would teach this problem using ABSTRACT symbols

What to do?

- Ensure student understanding through high-quality instruction using both student-centered and teacher-centered strategies.
  - ~~Procedural Understanding/Skill Acquisition (Instructional Focus Continuum)~~
  - ~~Conceptual Understanding (CRA model)~~
  - Scaffolded Instruction (I do, We do, Ya'all do, You do)

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Scaffolded Instruction

Gradual Release of Responsibility

"I do - We do –Y'all do- You do"

Explicit Instruction and Modeling

Guided Practice

Independent Practice

A Day in the Life of Effective Math…

The CORE and More Instruction Checklist

(Please note: This is not just a lesson plan… this is a framework for a 90 minute Math Block.)

The Core and MORE Instruction Checklist

The CCSS Standard:
The Envision Lesson:

EXPLICIT INSTRUCTION
I do it, We do it, Y'all do it, You do it

ENGAGEMENT
All Students Saying, Writing, Doing

PROACTIVE PLANNING

The following questions should be considered for each part of the lesson:

- What are the predictable failures for this lesson? (conceptually and behaviorally)
- How will you prevent these failures?
- What will you do to maintain consistency?
- How will you know if it is working?

VOCABULARY WORDS

❒ cumulative review ❒ higher-order thinking, ask why ❒ have students visualize, draw, model ❒ real-world contexts
❒ math vocabulary ❒ milk the data ❒ incorporate measurement ❒ number sense

ANTICIPATORY SET

(5 MINUTES)

Choose from the many options:

- ❒ *Review What You Know*
- ❒ *Interactive Math Stories*
- ❒ Math Journaling
- ❒ *Spiral Review*
- ❒ *Problem of the Day*

- ❒ Choral Responses
- ❒ Partner Responses
- ❒ Written Responses
- ❒ Random call on students (No hand raising)

BUILDING A FOUNDATION

(5-10 MINUTES)

The Language of Math: Vocabulary instruction

1- How will you explicitly teach new vocabulary?
2- How will you provide multiple opportunities for vocabulary to be used in context?

- ❒ Choral Responses
- ❒ Partner Responses
- ❒ Written Responses
- ❒ Random call on students (No hand raising)

WHOLE GROUP INSTRUCTION: Concrete

(10-15 MINUTES)

Develop the Concept: Interactive Learning (Hands-on)

1- What materials/manipulatives will you need?
2- Will each student have enough materials to model the problems?
-If they do not, will you have them pair up or adjust the problems?
3- Where will students record their work during this phase of the lesson?
4- How will you check for understanding during this phase of the lesson?
5- Will you use the *Extend*?
6- Will you use the *Link to Investigations*?

- ❑ Choral Responses
- ❑ Partner Responses
- ❑ Written Responses
  - ❑ Paper
  - ❑ Math Journal
  - ❑ Individual Whiteboards
  - ❑ Student page from the topic pouch
- ❑ Random call on students (No hand raising)

SCAFFOLDED INSTRUCTION: Representational

(15-20 MINUTES)

Develop the Concept: Visual

The *Visual Learning* Bridge, at the top of each lesson, is critical to connecting the Concrete to the Representational and then to the Abstract. Look for *Prevent Misconceptions*.

Choose one option:

- ❑ *Visual Learning Animation* (on-line or CD)
- ❑ Overhead Transparency
- ❑ *Visual Learning* Bridge in Student textbook
- ❑ Document camera

1- Check for understanding during the *Guided Practice*.
2- Where will students record their work?
3- If most students are struggling during this phase of the lesson, what will you do?
   - ❑ Reteach explicitly with various problems from the *Guided* or *Independent Practice* or the *Reteaching* sets at the back of the *Topic Guide*.
   - ❑ Use lessons from *Meeting Individual Needs*.
   - ❑ Use the *Differentiated Instruction: Intervention* lesson.
4- Will some of the problems from the *Problem Solving* be included in your *Guided Practice* or *Independent Practice*?

- ❑ Choral Responses
- ❑ Partner Responses
- ❑ Written Responses
- ❑ Random call on students (No hand raising)

INDEPENDENT PRACTICE: ABSTRACT (15-20 MINUTES)

Independent Practice and *Problem Solving*

1- Which problems will you assign?
2- Where will students record their work?
3- Will you collect, grade and record the independent practice?
4- How will you check for understanding?
5- If students do not finish the problems assigned for independent practice, will these problems be homework?

- ❑ Choral Responses
- ❑ Partner Responses
- ❑ Written Responses
- ❑ Random call on students (No hand raising)

FORMATIVE ASSESSMENT (5-10 MINUTES)

Concept Understanding

- ❑ PLC/Grade-Level common formative assessment
- ❑ *Quick Check* (in *Teacher Resource Masters)*
- ❑ *Writing to Explain*
- ❑ *Mind Game Quiz Show*
- ❑ Student buzzers or Aver Pens

Formative Assessment Tools

- ❑ *Topic tests* (online or in text)
- ❑ *Item Analysis for Diagnosis and Intervention*
- ❑ *Free-Response Test*
- ❑ *Performance Assessment*
- ❑ CBM-Math
- ❑ PLC/Grade-Level common formative assessment
- ❑ Other assessment tool

End of each Quarter:

- ❑ *District Common Formative Assessment* (CFA)

CENTER ACTIVITIES

(15 - 45 MINUTES)

*This part of the lesson is beneficial for providing engaging activities while the teacher works with small groups of students who need supplemental instruction.

Choose from the many options:

- ❑ *Differentiated Instruction*
- ❑ *Math Project*
- ❑ *Meeting Individual Needs*
- ❑ Teacher-led interventions
- ❑ *Leveled Homework*
- ❑ Online games from *Envision Digital Premium*

1- Will you do these activities and if so, when?
2- When will you give directions on how to play?
3- What materials will be needed for the activities?
4- Will you work with the Intervention group?
5- How will you determine which activities will be assigned to each group of students?

HOMEWORK

Choose from the many options:

- ❑ Finish *Independent Practice* and/or *Problem Solving* assignment
- ❑ *Spiral Review*
- ❑ *Quick Check*
- ❑ *Leveled Homework*
- ❑ Online games from *Envision Digital Premium*
- ❑ Online tutorials from *Envision Digital Premium*

1- Will you collect and grade homework?
2- Will you discuss homework? Is so, when?

Tier 1 Core Instruction Summary

The Focus	Every student
The curriculum	Scientific-based math instruction w/emphasis on explicit instruction and application of critical concepts and standards identified by the Common Core
The instruction	High Yielding Instructional Practices!
Grouping	Whole group direct instruction and small group skill-based instruction matched to student needs
Time	90 minutes per day
Assessment	CBM Benchmarks 3x/year Common formative assessments Formative classroom assessments
Interventionist	The general education teacher
Setting	The general classroom